Remarks

Claims 1, 3-7, 9-35 and new claim 36 are pending, with claim 1 being independent. Claim 1 has been amended to even more clearly recite and distinctly claim the present invention. New dependent claim 36 has been added. Support for the claim amendments and new claim can be found throughout the specification, including, page 8, lines 23-28; page 8, line 29 – page 10, line 31, Examples 1-4, Examples 9-15, and Example 17. Therefore, Applicants respecfully submit that no new matter has been added.

Applicants respectfully request the Examiner to withdraw the outstanding rejections in view of the foregoing amendments and the following remarks.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1, 3-7, 9-13, 18, 20-22, 26-28, 31, and 35 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Callahan (US 2002/0010261) in view of Cantiani (WO 0015887; US 6,703,497) and further in view of Fukutomi (EP 1031598). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As noted above, claim 1 has been amended to even more clearly recite and distinctly claim the present invention.

The presently claimed ionic conduction material comprises a polymer matrix, at least one ionic species, and at least one reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils, wherein a reinforcing agent network is formed in the ionic conduction material from the reinforcing agent being brought into contact with the polymer of the polymer matrix. Applicants note that the cellulosic material is comprised of cellulose single crystals or of cellulose microfibrils, which are highly crystalline and provide mechancial strength due to their physical properties.

Moreover, a reinforcing agent network is formed in the ionic conduction material from the reinforcing agent being brought into contact with the polymer of the polymer matrix. The intimate mixture of the reinforcing agent and the polymer of the polymer matrix optimizes the electric conductivity of the ionic conduction material while presenting good mechanical strength properties, as demonstrated in Examples 1-4, 9-15, and 17. In contrast,

as shown in Examples 5-8 and 16, a film of a reinforcing agent applied by lamination on a polymer materix requires a larger amount of reinforcing agent to obtain the mechanical strength. Furthermore, even if enough is used to confer the desired mechanical strength, the film of reinforcing agent reduces the conductivity, which is not favorable to its use as an electrolyte of a battery, fuel cell, supercapacitor, or an electrochromic device, or component of a composite electrode.

Callahan relates to a polymer matrix material suitable for supporting a liquid solution. (Abstract) The polymer matrix material comprises a polymerization product of a first type of one or more monomers selected from the group of water-soluble, ethylenically-unsaturated acids and acid derivatives. ([0053]). The polymer matrix material also includes a second type monomer, generally as a crosslinking agent. ([0053]). Further, the polymer matrix material may include a water-soluble or water-swellable polymer, which acts as a reinforcing element. ([0053]).

Callahan discloses that the water soluble or water swellable polymer, which acts as a reinforcing element, may comprise polysulfone, poly(sodium-4-styrenesulfonate), carboxymethyl cellulose, sodium salt of poly(styrenesulfonic acid-co-maleic acid), corn starch, any other water-soluble or water-swellable polymers or combinations comprising at least one of the foregoing polymers. ([0064]). As described, these reinforcing elements are either soluble or swellable in water (acting as a gel). The reinforcing agents of Callahan do not confer any mechanical strength.

With regard to Cantiani, Applicants note that WO 00/15887 is entitled a Method for Preparing or Purifying Aqueous Solutions of a Tertiary Amino-Oxide and claims priority to an Austrian patent application. US Patent No 6,703,497 is entitled Cellulose Microfibrils with Modified Surface, Preparation Method and Use Thereof and claims priority to a French patent application. The '497 patent lists Cantiani as the fourth named inventor. Applicants note that the PCT application of the '497 patent is WO 00/15667. Applicants believe that WO 00/15667 was the intended citation of the Examiner and provide comments regarding the '497 patent (Cantiani).

Cantiani describes cellulose microbibrils with modified surface characterized in that the hydroxyl functions present at the surface of the microfibrils are etherified with at least an organic compound comprising at least a function capable of reacting with the hydroxy

functions. Cantiani further describes the use of these microfibrils as an agent for modifying viscosity, texture, and/or as a reinforcing filler. Cantiani provides a detailed description of the cellulose microfibrils with modified surface and of the method for making the microfibrils. However, Cantiani only provides a terse and generalized description of their use as viscosifying agents and reinforcing filler in thermoplastics and thermosetting materials. The one described and expemplified use is in a vulcanized elastomer, which can be used in any part of the tire. (Col. 10, lines 62-65 and Example 8).

Applicants respectfully submit that Cantiani does not disclose or suggest a reinforcing agent comprised of cellulose microfibrils and this reinforcing agent forming a reinforcing agent network in an ionic conduction material from the cellulose microfibrils being brought into contact with a polymer of a polymer matrix.

Fukutomi relates to an ion-selective membrane formed of an ion-selective membrane forming component and a woven-fabric-shaped backing. Fukutomi discloses that the woven-fabric-shaped backing has a meshed structure.

Applicants respectfully submit that Fukutomi does not disclose or suggest ***ionically conductive materials*** as presently claimed. In contrast, Fukutomi discloses selectively ***ion-permeable*** materials. Applicants respectively submit that ionically conductive materials are significantly different than ion-permeable materials. An ionically conductive material, as presently claimed, is a material that conducts ions. Accordingly, the nature of the material provides the mobility of the anions and cations, the mobility of the ionic species increasing when the degree of crystallinity and the glass transistion temperature decrease. In contrast, the ion-selective material of Fukutomi is a film or sheet of a substance that is preferentially permeable to some species or types of ions. The ion-selective material does **not** conduct ions but allows selective permeation.

Moreover, Fukutomi discloses a ***woven-fabric backing*** having a meshed structure. Accordingly, the cellulosic material used in Fukutomi is in the form of a ***woven sheet***. Applicants respectfully submit that a cellulosic material in the form of a woven sheet is significantly different than the presently claimed reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils and a reinforcing agent network is formed in the ionic conduction material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Fukutomi does not disclose or suggest the presently claimed reinforcing agent comprised of cellulose single crystals or of cellulose microfibrils. Moreover, Fukutomi does not disclose or suggest a reinforcing agent network formed in an ionic conduction material from the reinforcing agent being brought into contact with a polymer of a polymer matrix. As demonstrated in the present Examples, even using the presently claimed reinforcing agents, there is signficant improvement when a reinforcing agent network is formed in the ionic conduction material (Examples 1-4, 9-15, and 17) in comparison to a film of reinforcing agent applied by lamination on a polymeric matrix (Examples 5-8 and 16).

Therefore, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

For at least the above noted reasons, Applicants respectfully submit that claims 1, 3-7, 9-13, 18, 20-22, 26-28, 31 and 35 are not obvious over Callahan in view of Cantiani and further in view of Fukutomi, and Applicants respectfully request withdrawal of this rejection.

Claims 14-17, 19, and 32-34 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Callahan in view of Cantiani and Fukutomi and further in view of Hirakawa (US 5,281,495). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Hirakawa discloses a rechargeable alkaline storage cell having a negative electrode, a positive electrode, and a separator disposed between the electrodes. Hirakawa is cited for disclosing electrodes comprising carbon as conductive material and the use of manganese as insertion material. Hirakawa does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Hirakawa as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Fukutomi. Accordingly, even if combined, Callahan, Cantiani in view of Hirakawa do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Fukutomi, and Hirakawa do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claim 23 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Callahan in view of Cantiani and Fukutomi and further in view of Nielsen (US 2002/0010261). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed. Applicants note that claim 23 further defines the electrolyte for a lithium polymer battery.

As described above, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Nielsen discloses an adhesive composition containing hydrocolloids in the form of discrete particles wherein the adhesive composition comprises a matrix comprising one or more amorphous poly-α-olefins.

The adhesive composition of Nielsen is a ***pressure sensitive adhesive suitable for application to human or animal skin***. Applicants respectfully submit that a pressure sensitive adhesive composition is in no way applicable to an ionic conduction material. Applicants respectfully submit that in no way is there suggestion or motivation to combine any aspect of the pressure senstive adhesive composition suitable for application to skin of Nielsen with the polymer matrix material for supporting a liquid solution of Callahan.

Moreover, even if combined Callahan in view of Cantiani and Fukutomi and further in view of Nielsen do not disclose the presently claimed ion conduction material.

Nielsen as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Fukutomi. Accordingly, even if combined, Callahan, Cantiani in view of Nielsen do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Fukutomi, and Nielsen do not disclose or

suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claims 24 and 25 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Callahan in view of Cantiani and Fukutomi and further in view of Tossici (US 6,087,043). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Tossici discloses a lithium-ion rechargeable battery with carbon-based anode containing a lithium intercalating compound, a non-aqueous lithium ion-conducting electrolyte, and a carbon-based anode compirisng KC_8.

Tossici does not disclose or suggest that the anode also contain a reinforcing agent as presently claimed wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils and further wherein a reinforcing network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Tossici as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Fukutomi. Accordingly, even if combined, Callahan, Cantiani in view of Tossici do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Fukutomi, and Tossici do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claim 29 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Callahan in view of Cantiani and Fukutomi and further in view of Skotheim (US 4,442,185). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest, at least, an ionic conduction material

comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Skotheim relates to a photoelectric device. Skotheim is cited as disclosing a solar cell comprising a photoanode and a cathode separated by electrolyte. Skotheim does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Skotheim as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Fukutomi. Accordingly, even if combined, Callahan, Cantiani in view of Skotheim do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Fukutomi, and Skotheim do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claim 30 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Callahan in view of Cantiani and Fukutomi and fruther in view of Niu (US 6,205,016). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Fukutomi do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Fukutomi do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Niu discloses composite electrodes for use in electrochemical capacitors. Niu is cited for disclosing a supercapacitor comprised of an electrochemical cell. Niu does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Niu as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Fukutomi. Accordingly, even if combined, Callahan, Cantiani in view of Niu do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Fukutomi, and Niu do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Conclusion

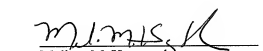
For at least the reasons noted above, the art of record does not disclose or suggest the inventive concept of the present claims.

In view of the foregoing amendments and remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. If there are any questions relating to this response or the application, Applicants would appreciate the Examiner contacting the undersigned attorney to expedite prosecution.

If necessary for a timely response, this paper should be considered as a petition for an Extension of Time and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 13-2725 (Docket # 70206.0005FPWO).

Respectfully submitted,

12 May 2010



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